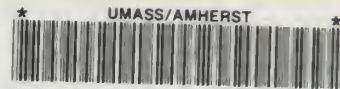


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EMPLOYMENT TRENDS AND TECHNOLOGICAL CHANGE
IN THE PRINTING AND PUBLISHING INDUSTRY

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DIVISION OF EMPLOYMENT SECURITY

Michael S. Dukakis, Governor



EMPLOYMENT TRENDS AND TECHNOLOGICAL CHANGE
IN THE PRINTING AND PUBLISHING INDUSTRY

Mature Industries Research Department
June, 1987

EXECUTIVE SUMMARY

- * The Massachusetts printing and publishing industry is one of a handful of traditional manufacturing industries to experience job growth over the past several years. Employment in printing and publishing rose by 15.1% in the 1980-1985 period, exceeding the 13.5% rate of growth in state private sector employment for those same years. Employment growth in this industry has been projected by DES to slow to 10% between 1984 and 1995, but it is still expected to far outpace the performance of the manufacturing sector overall.
- * The printing and publishing industry is made up of nine distinct segments. In Massachusetts, employment is concentrated in newspapers, commercial printing, periodicals, book publishing and printing, and blankbooks and bookbinding. These industry segments have different occupational structures and ownership patterns, and face different market conditions. Each industry segment is also implementing technological change in its production process at somewhat different rates.
- * The performance of the printing and publishing industry has been a welcome development. Many of the industry's jobs are relatively well-paid and are characterized by upward career paths. Moreover, printing and publishing has remained an important source of skilled production jobs in Massachusetts cities at a time when manufacturing employment overall has declined in these areas.



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- * Job growth in printing and publishing has taken place despite technological change in the industry, which has reduced the amount of labor needed to produce a unit of output. In addition to boosting productivity, however, technological innovation has significantly affected the types of jobs that printing workers perform.
- * Historically, the industry has been known for its skilled craft workers, who traditionally learned their trades through a lengthy apprenticeship process. Although the skilled nature of printing work has continued longer than in many other manufacturing industries, technological innovation is changing the nature of skills required and some traditional training methods. While on-the-job training is still important in most skilled printing occupations, workers may also benefit from vocational or post-secondary technical school training. Indeed, employer efforts to retrain and augment the skills of existing workers may become increasingly important in the industry segments that are experiencing job growth and technological change.
- * While the printing and publishing industry has a wide variety of products, the stages of production are very similar across industry sectors. Writers, artists, designers and clerical workers prepare the content of printed products. Pre-press workers, including typesetters, photoengravers and platemakers, transform material into something printable. Press operators then do the printing. Finishing and distribution, which vary with the product, are done by finishing, binding, and mailroom workers.



- * Technological change is occurring in virtually all phases of the printing process. Workers in pre-press occupations, particularly typesetters, were dramatically affected by the introduction of photocomposition beginning in the mid-1960's. New electronic pagination systems, which allow computerized integration of text and graphics, are expected to reduce per-unit labor requirements appreciably in typesetting and composition and perhaps in other pre-press occupations. Computerized platemaking and press technologies are also being developed.

- * Technological change, which has had a significant impact over the last 20 years, is still the most important force affecting the supply side of the industry. At the same time that technological change is affecting the industry by reducing overall unit labor requirements, many segments of printing and publishing are also experiencing growth in product demand. Future employment trends will reflect the combined effects of technological change and demand growth, and thus will vary across different parts of the industry. In the industry's largest segments, demand growth will continue, and employment is projected to increase. Thus, as noted previously, overall printing and publishing employment is expected to rise over the next decade.

- * As firms introduce new technologies, however, some employment reductions may occur, particularly if demand growth slows down. Employer-sponsored retraining, separation pay and similar measures may be important to prevent or minimize worker dislocation when job reductions occur. Public retraining and placement efforts can also



facilitate the adjustment process for workers in the industry.

- * As noted earlier, the industry's training requirements and methods are changing as new printing technology is introduced and job content and skills evolve. The apprenticeship system has served as a mechanism for training and upward mobility for many printing occupations, but is no longer widely used. Planning for new kinds of training would ensure that employers' hiring needs and workers' retraining requirements are met adequately. Such a planning effort, which might involve printing employers, unions, equipment manufacturers, educators and employment and training specialists, could also promote options for women and minorities in the printing industry.

ACKNOWLEDGEMENTS

The Mature Industries Research Department wishes to express its thanks to a number of individuals for their assistance during the research and writing of this report.

Elliot Winer, the DES Chief of Economic Research and Analysis, provided technical assistance throughout the project. Kerry Stackpole of Printing Industries of New England and David Grossman of the New England Press Association were important sources of background information on commercial printing and newspapers, respectively. Dr. Frank Trocki of Northeastern University and Lou Generazzo from Northeast Metropolitan Regional Vocational School helped the Department to understand some of the major technological changes affecting printing and publishing as well as the labor implications of these changes. Assistance of various kinds was also provided by Bob Richter of Friends of the Printing Museum; Norman Hansen, publisher of New England Printer and Publisher; John Sargent of Interconsults; Robert Critchlow of the Bureau of Labor Statistics; William Lofquist of the U.S. Department of Commerce; Dr. Nelson Eldred from the Graphic Arts Technical Foundation; Professors Gregory Giebel of the University of the District of Columbia and Michael Wallace of Ohio State University; graphic arts consultants Frank Romano and Michael Bruno; and Sabena Quitslund of Harvard University.

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INTRODUCTION

The Massachusetts printing and publishing industry, which employs over 50,000 workers, or approximately 2% of the state's work force, is one of a handful of traditional manufacturing industries in the Commonwealth to experience job growth over the past several years. Indeed, since 1980, the rate of employment increase in printing and publishing has surpassed that of the Massachusetts private sector overall. The relatively high rate of job growth has taken place in spite of an ongoing process of technological change that has significantly reduced the amount of labor necessary to produce a unit of output. In many cases, technology has also altered skills and the content of jobs and has reduced training requirements.

Historically, the industry employed well-paid, highly-skilled craft workers, who were trained through a lengthy apprenticeship process. Many of these workers, particularly in newspapers, were organized into strong trade unions. As innovation has proceeded, however, there has been a blurring of craft distinctions in some phases of the production process, and employment levels in at least one phase of printing -- composition -- have fallen appreciably. Other forces that are affecting jobs in various segments of printing and publishing include the emergence of "desktop publishing" (itself the result of advances in technology), competition from electronic media, and the growth of direct mail advertising.

Because the industry employs a relatively large number of Massachusetts workers and is offering expanding job opportunities, the impacts of changing technology and other factors impinging upon printing and publishing is an important topic for investigation. By identifying industrial and

occupational trends, for example, a study of these issues can assist in job placement efforts, while a summary of changing job content and skills may contribute to the design of educational and training programs. These concerns have shaped the research and writing of this report, which focuses on the following questions:

1. What have been the basic employment trends in the major segments of the industry? What forces underlie these trends?
2. How has technological innovation -- the most important of these forces -- affected the production process and the nature of jobs?
3. How have technological changes and other economic developments affected employment levels, the structure of occupations, and training requirements?

OVERVIEW

At a time when many of Massachusetts' traditional manufacturing industries are losing jobs, the printing and publishing industry stands out as an important exception. From 1980, employment in the industry grew 15% to its 1985 level of 52,000 workers. Over the next ten years, employment is projected by DES to increase by 10%. In contrast to most other nondurable goods industries, printing and publishing is relatively insulated from direct international competition. In addition, the industry's markets are closely linked to many of the growing service industries, and to overall spending on advertising. Thus, the printing and publishing industry has benefitted from overall state economic growth.

Production workers in printing and publishing generally earn high wages and have stable jobs. The industry is perhaps best known for its skilled craft workers, such as typesetters and press operators, who traditionally learned their trades through a lengthy apprenticeship process. The skilled nature of printing work has continued longer than in many other manufacturing industries. Part of the dynamism of the industry, however, is due to substantial technological innovation in its production processes, which is changing the nature of skills required and some traditional training methods.

Employment in the printing and publishing industry nationally has historically been concentrated in large cities such as New York, Chicago, Philadelphia, Los Angeles and Boston. In both the newspaper and commercial printing sectors, for example, employers typically located in central urban

areas to be close to their customers. In Massachusetts cities, particularly Boston, the printing industry has remained a relatively important source of skilled production jobs at a time when cities are losing manufacturing employment. Indeed, between 1980 and 1985, printing and publishing employment remained fairly level in the city of Boston, while total manufacturing jobs fell by almost 20%.

Throughout the industry, however, there has been a national trend over the last two decades toward geographic relocation: printing employment growth has shifted away from most major centers, especially those in heavily unionized cities in the northeast.¹ In the late 1960's and early 1970's, Boston and other northeastern cities experienced a net loss in printing employment, while national industry employment increased moderately. During the same period, both employment and the number of printing establishments grew rapidly in rural, suburban and southern areas of the country. Since that time, growth in the industry has continued at a much slower rate in the northeast as a whole than in other regions of the country. In 1986, over half of all commercial printing plants were located in southern and western states.

Trends in Massachusetts in the 1980s have diverged from those in the northeast. Between 1960 and 1980, Massachusetts printing and publishing employment grew at an average annual rate of less than 1% a year, much more slowly than the national rate of employment growth in the industry. Between 1980 and 1985, however, printing employment in Massachusetts grew by 2.8% annually, slightly faster than the 2.6% nationwide rate of employment growth in the industry (Exhibit 1). Periodicals and newspapers grew much more rapidly in Massachusetts than in the nation, while the growth in most other

Exhibit 1

Employment Trends in Selected Sectors, Massachusetts and U.S., 1980-1985

	1980-1985 % Change <u>Massachusetts</u>	1980-1985 % Change <u>National</u>
Commercial Printing	19.4%	18.0%
Newspapers	16.9	8.0
Books	5.9	5.1
Blankbooks and Bookbinding	- 8.7	13.6
Periodicals	69.8	21.6
Printing Trade Services	18.3	15.7
Total Printing and Publishing	15.1	13.5

Source: Division of Employment Security, ES-202 reports and CES-790 series

segments approximated the national rate. State employment in blankbooks and bookbinding actually fell during this period, while nationally jobs in this sector increased.

The production process in the printing and publishing industry has also changed significantly over the last twenty years. New technology introduced during this period has affected most occupations in printing, altering work processes that had remained fundamentally unchanged for decades. Automated equipment has reduced the need for some occupations and radically changed the tasks performed by many workers. After more than two decades of significant technological change, the industry is still in a period of transition.

Industry Trends

Printing and publishing is made up of nine distinct segments, including commercial printing, newspapers, books, and periodicals (Exhibit 2). Occupational structures and ownership patterns vary among different parts of the industry; each sector faces different market conditions as well. Moreover, most of the industry segments are implementing technological change in their production processes, but at uneven rates. Thus, before discussing technological and occupational change, it is helpful to sketch a brief picture of the most important industry segments in Massachusetts.

Commercial printing and newspapers are the major employers. Periodicals, book publishing and printing, and blankbook printing and bookbinding are also important sources of jobs. Printing trade service shops, while employing relatively few workers, are growing rapidly and are

Exhibit 2

Printing and Publishing Employment by Industry Segment, 1980-1985

<u>Industry Sector</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>% Change, 1980-1985</u>
Commercial Printing	15,006	15,228	15,446	16,255	17,559	17,922	19.4%
Newspapers	12,994	12,977	13,274	13,364	13,987	15,190	16.9
Books	6,032	6,053	5,963	6,007	6,051	6,389	5.9
Blankbooks and Bookbinding	4,958	4,948	4,809	4,798	4,712	4,528	- 8.7
Periodicals	2,067	2,301	2,547	2,748	3,167	3,511	69.8
Miscellaneous Publishing	1,509	1,544	1,544	1,597	2,427	2,139	41.7
Printing Trade Shops	1,134	1,185	1,234	1,217	1,290	1,341	18.3
Greeting Card Publishing	1,063	708	376	426	460	482	-54.7
Business Form Printing	549	545	539	551	571	584	6.4
Total Printing & Publishing	45,262	45,489	45,732	46,963	50,224	52,086	15.1

Source: Division of Employment Security, ES-202 reports

likely to be an area of substantial technical change. With the exception of blankbooks and bookbinding, employment in each of the major segments is concentrated in the Boston labor market area (Exhibit 3).

In 1985, the newspaper industry employed 15,190 workers, close to one-third of all printing and publishing employment in the state. While employment in big-city newspapers is levelling off or declining, smaller suburban newspapers seem to be growing; as a result, overall industry employment has expanded in recent years.

The newspaper industry is highly concentrated in both ownership and employment. Seventy percent of all U.S. daily newspapers are owned by large chains; acquisition activity is expected to continue and lead to greater concentration of ownership. In Massachusetts, more than half of all newspaper workers are employed by firms of over 500 workers.

The financial health of newspapers depends in large part upon advertising revenues, which fluctuate with the business cycle. In addition, newspapers compete with other media for advertisers' dollars, and have captured a declining share of total ad spending. Of particular concern to the industry are direct mail advertising, ads in the form of pre-printed inserts, which are generally printed by commercial printers, and local TV and cable TV advertising. Newspapers are also under pressure to target their ads to more localized audiences. In order to compete with suburban newspapers, many large city newspapers publish zoned editions in which advertising is tied to local markets.

Exhibit 3

Geographical Distribution of Printing and Publishing Employment, 1985

<u>Industry Segment</u>	<u>Percent of Employment in Labor Market Area</u>				<u>Balance of State</u>
	<u>Boston</u>	<u>Springfield</u>	<u>Worcester</u>	<u>Lowell</u>	
Commercial Printing	65%	7%	5%	5%	18%
Newspapers	51	11	7	7	24
Books	73	1	2	2	22
Blankbooks & Bookbinding	40	43	-	-	17
Periodicals	87	2	2	2	7
 Total Printing & Publishing	 61	 11	 5	 4	 19
 Massachusetts Private Sector Employment	 57	 8	 6	 3	 26

Source: Division of Employment Security, ES-202 reports.

Nationally, the newspaper industry has traditionally been highly unionized. In Massachusetts, the extent of unionization in big-city papers is much greater than in smaller suburban newspapers. According to case study interviews, recent circulation and employment growth has occurred mainly in suburban papers. In New England as a whole, circulation growth in daily newspapers, which tend to be the large, city newspapers, rose only 7% from 1980 to 1986. Weekly newspapers, on the other hand, which are primarily smaller, suburban papers, have increased their circulation by more than 150% over the same period.

Commercial printers in Massachusetts employ an even larger number of workers (17,922 in 1985) than does the newspaper industry. Commercial printing employment has been growing rapidly in the last few years in the state as well as the nation, but is expected to slow down in the future. Commercial printers depend on advertising spending as well, in magazines, direct mail, inserts, etc. Thus, the industry has boomed during the current cyclical upswing, but its expansion is moderating as the rate of economic growth slows.

Commercial printing technology has become increasingly sophisticated, especially in its use of color. The industry is highly competitive; as a result, many commercial printers thrive by specializing -- printing only periodicals or financial documents, for example.

In Massachusetts, commercial printing is composed of many small firms. Seventy-five percent of commercial printers employ fewer than 20 workers, and 60% of all workers are employed in firms with fewer than 100 employees. Although most Massachusetts commercial print shops are not unionized,

national data indicate that production workers' average earnings in commercial printing are among the highest of all printing and publishing sectors.

Anecdotal evidence suggests that quick-print shops -- walk-in establishments that do xeroxing and simple offset printing -- are growing rapidly, especially in large cities. (This growth is very difficult to quantify. Some quick-printers are classified as commercial printers, while others are categorized as business services and thus are not included in the printing industry.) Many quick-print shops are franchises. Case study interviews suggest that they are highly competitive and represent the lowest-wage end of the industry.

Firms that print and/or publish books employed 6,389 workers in 1985. In general, publishers solicit manuscripts and edit, design, and market books, while actual production is done by printers. This industry segment grew moderately over the past few years and is likely to continue at a similar pace. This stable growth masks divergent trends between the parts of industry: employment in book publishing is actually growing rapidly, while book printing employment is on the decline. In 1981, book printing firms employed 38% of all book industry workers; by the second quarter of 1986, that share had declined to 29%. These trends reflect nationwide growth patterns as well as some interregional shifts. Book printing, once centered in northeastern and northcentral cities, has been declining in those areas and expanding in the South and Midwest, where the population is growing more rapidly. Case study interviews with Massachusetts publishers indicate that much of their printing is currently done in the Midwest. Book publishing, however, is likely to remain and grow in Massachusetts, due to

the state's importance as an intellectual and academic center. In addition, the publishing industry's historical roots in the Northeast have also created a labor pool that publishers are not anxious to abandon.

Data on the structure of the book publishing industry in Massachusetts show that, while employment is concentrated in large firms, there is a large share of very small firms in the industry: 77% of all publishing firms employ fewer than 20 workers, while 44% employ fewer than five. However, ownership may be becoming more concentrated in the publishing industry as well; recent business press reports cite some of the larger publishing houses as merger and takeover targets.

The book industry is one of the few printing and publishing segments subject to international competition. In 1986, book imports exceeded exports. As books have a much longer turn-around time than other printed matter, it is also possible for publishers to out-source particular parts of the production process abroad. Currently, many artbooks and children's books are printed abroad, and some labor-intensive pre-press work, such as color separation and typesetting, is also performed for U.S. publishers in lower-wage countries such as Ireland and Singapore.

Until 1986, the U.S. copyright law contained a manufacturing clause which ensured that books by U.S. authors that were primarily text (not pictures) would be printed in the U.S. Now that this clause has expired, U.S. book printers will be subject to increased competitive pressure. Book industry spokespeople claim the removal of this domestic content requirement will be disastrous. Other industry experts are less alarmed, predicting a period of lowered profit margins and perhaps declining employment that will

not constitute a major threat to the industry.

The periodicals industry, which in 1985 employed 3,511 people, or 7% of all printing and publishing workers, has grown faster than most other segments of the Commonwealth's printing and publishing industry. Most periodicals firms are publishing rather than printing enterprises; the actual printing of the magazines is usually done by commercial printers. While growth in the industry nationwide has been strong, Massachusetts employment grew three times as fast as national employment from 1980 to 1985. Industry experts attribute national growth in periodicals to general economic expansion since 1982, increased advertising spending, and a proliferation of specialized publications. In Massachusetts, one industry commentator noted that the explosion of trade, industry, and specialty magazines in the last few years had saturated the market for periodicals. Competition within the periodicals segment has intensified along with the rapid increase in the number of publications. Nationally, the industry may also be becoming more concentrated, as large publishing and other media companies acquire smaller magazine companies.

As is true of most of the key printing and publishing segments, the vast bulk (87%) of periodicals employment is located in the Boston labor market area. In recent years, however, much of the employment growth in periodicals has taken place in surrounding suburbs rather than in the city of Boston.

National data indicate that average wages for non-supervisory workers in periodical publishing firms are close to those earned in other high-wage sections of the industry, such as commercial printing. Since they do not do

much printing, periodical firms are less likely to employ production workers and more likely to employ clerical workers and managers than are other parts of the printing and publishing industry. Over 40% of all jobs in periodicals are clerical occupations, and 20% of employment is classified as managerial.

The blankbooks and bookbinding segment of the industry employed 4,528 workers in 1985. This segment includes firms that print date books, note pads, and other office supplies, as well as those that bind printed material. Approximately twice as many workers are employed in blankbook firms than in bookbinding. However, employment in both subsectors has been declining steadily for the past five years, and little employment growth is expected over the coming decade.

Bookbinding and blankbook firms employ a relatively higher share of production workers than do other printing and publishing firms. According to national data, wages in this segment are the lowest in the industry. In Massachusetts, employment in blankbook printing firms is concentrated in large firms, whereas bookbinding firms tend to be much smaller. Approximately two-thirds of all bookbinding firms employ fewer than 20 workers. The comparable figure for blankbook firms is only one-third.

Printing trade service shops, which provide services such as typesetting and specialized color work, employed fewer than 1,500 workers in 1985. Although they account for only 3% of total printing industry employment, they have grown rapidly since 1980. Wages in this small industry segment are the highest in the printing and publishing industry, reflecting the large share of highly skilled craftspeople and technicians

who are employed there.

A substantial amount of printing also occurs outside of the printing and publishing industry in in-plant printing. Many large firms in diverse industries have self-contained printing departments with presses, duplicators, or laser printers. Although workers in these departments use skills similar to those of certain printing industry workers, this employment is not categorized as printing and publishing employment under SIC 27.

Data from the Graphic Arts Technical Foundation (GATF) give an idea of the magnitude of in-plant printing employment. In Massachusetts, according to GATF estimates, 2,100 printing departments within non-printing industry firms spend approximately \$800 million on their in-house printing activities. Average employment in in-plant printing departments nationally is between eight and nine workers. Applying this figure to Massachusetts, total in-plant printing employment is approximately 17,800 -- a level roughly equal to that of commercial printing, the largest printing and publishing sector. GATF predicts that in-plant printing facilities will grow by 3-4% over the next five years.

Because of data limitations, little can be said about the occupations and wages in in-plant printing departments. Thus, the analysis that follows excludes in-plant printing. A later section on technological change, however, discusses how new technologies may enable users of printing services to do some pre-press operations (e.g., typesetting and page make-up) in-house, even if the actual printing is undertaken by commercial printers.

The Production of a Printed Product

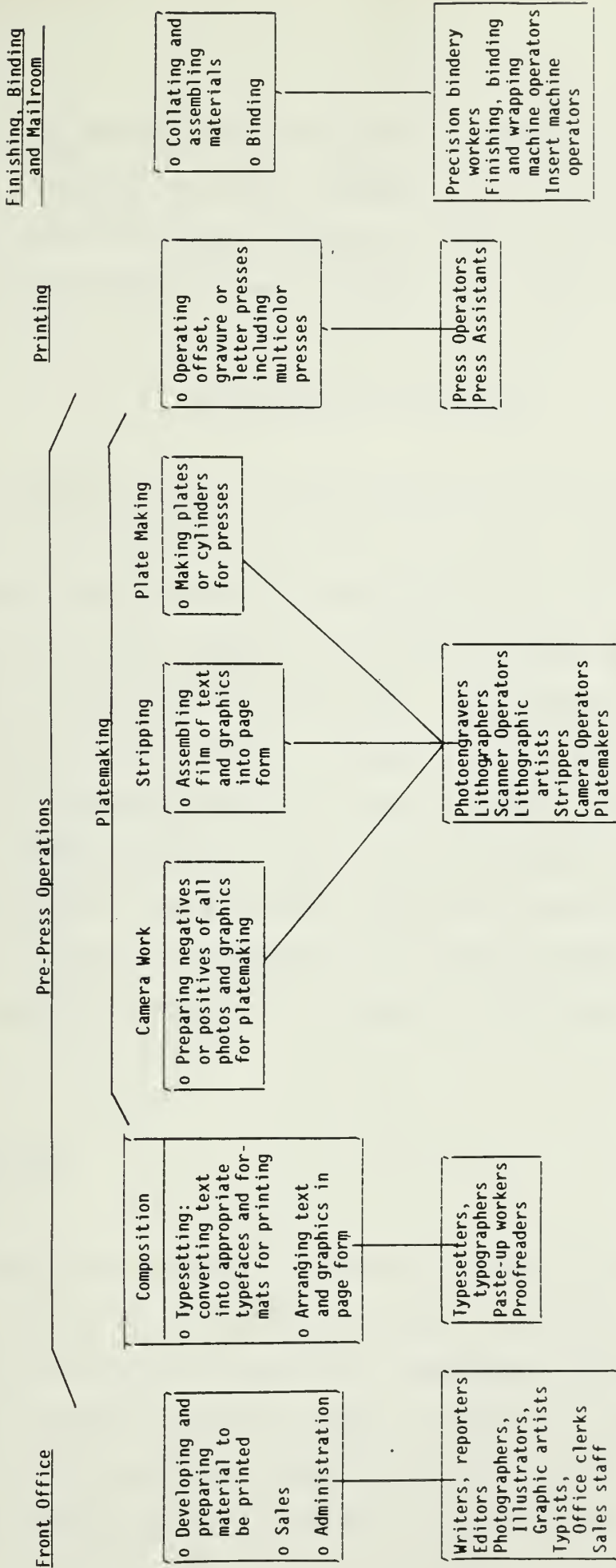
While the printing and publishing industry generates a wide variety of products, the stages of production are very similar across the sectors (Exhibit 4). The content of the printed product -- whether a newspaper's columns and photos, the stories and graphics of a glossy magazine, or the copy for advertising inserts and coupons -- is prepared by a front office of white collar professionals and support personnel. Writers, artists, designers and clerical workers can prepare copy for production anywhere -- in a composing room next to the pressroom or in an office half a continent away.

The material then goes to pre-press operations, where the ideas and artwork are transformed into something printable. Text is typeset in columns appropriate for printing, and is laid out with photos or graphics in page form. A negative of the layout is then produced, which in turn is used to make a printing plate through a photographic exposure process. The plate is then fitted onto a printing press.

Three different printing processes -- lithography, letterpress, and gravure -- are used to varying degrees across the industry. The most common process is offset lithography. In offset printing, flat, light metal plates transfer the inked image to a rubber "blanket" cylinder. The rubber cylinder is then rolled over the paper to print the image. Letterpress printing traditionally used raised lead plates to print directly on paper; flexography, the only commonly-used letterpress process today, uses rubber or plastic plates. Gravure requires the image to be etched onto a cylinder. Recessed cells hold the ink until the cylinder is rolled over paper.

Exhibit 4

The Printing Process and Its Associated Occupations



The final finishing stages vary with the product: assembling pages and sections in newspaper production, stamping, gluing, or stitching magazines and books, and binding spiral notebooks and commercial forms. The mailroom or shipping department then wraps and packs the product.

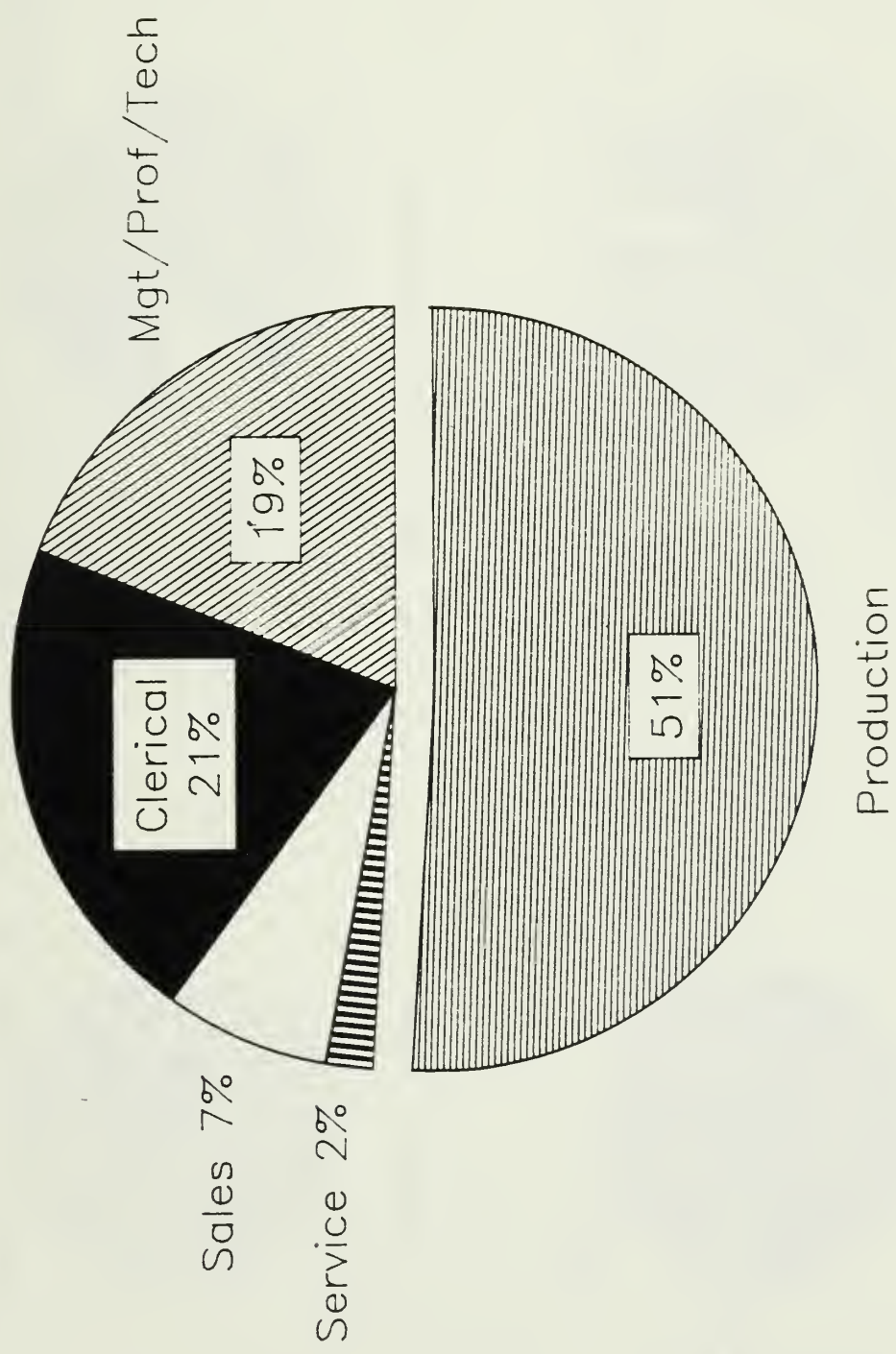
The Industry's Occupations

The industry's jobs are divided between the front office and the production and distribution areas (Exhibits 5 and 6). White collar professionals and clericals are concentrated in the front office. Compared to other manufacturing industries, skilled workers make up a relatively large share of the production work force. These include lithographers, photoengravers, camera operators, strippers, and typesetters in pre-press work, as well as press operators and bindery workers in the pressroom and finishing and binding areas. There are a large number of semiskilled workers who operate some of the less sophisticated machinery and who finish the product. While the distribution of occupations differs across industry segments, job-specific skills in one sector are often transferable to another.

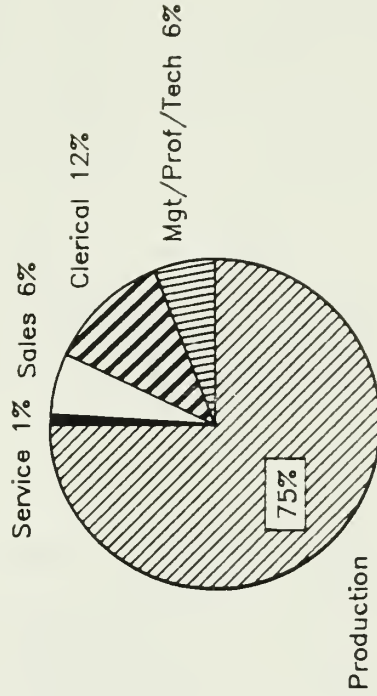
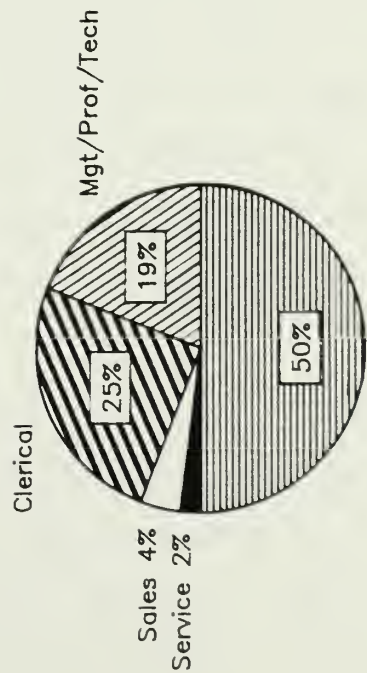
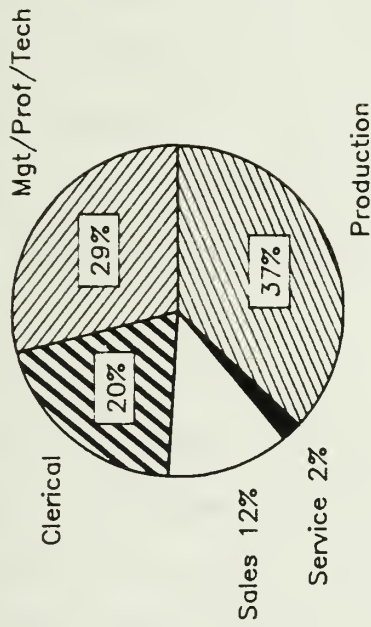
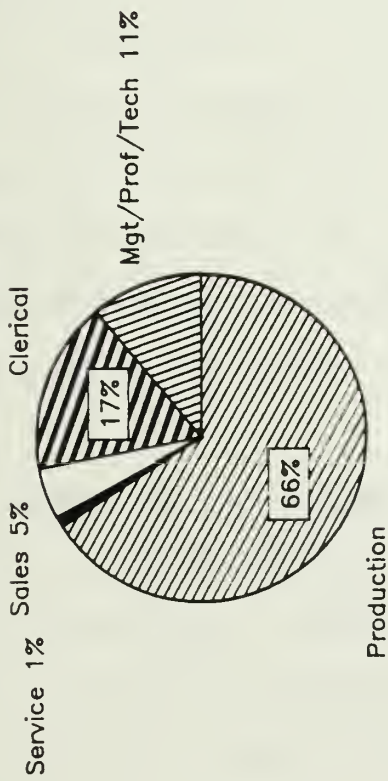
Pre-Press Jobs

1. Composition workers are involved in the tasks of preparing text and graphics for printing in the composing rooms of newspapers, commercial printers, and specialized trade shops. Typesetters convert the writers' text into a medium for printing, usually by typing on a computer terminal linked to a phototypesetter. Compositors arrange columns of type, pictures and graphics according to a front office layout and make proofs to preview

Distribution of Occupations in Printing & Publishing



Occupational Distribution in Selected Industry Sectors



the look of the page. The training required of typesetters varies considerably in different jobs. Typesetters who are setting complex one-time-only display ads, for example, need substantial background in how to choose and fit type. (These highly skilled typesetters are also sometimes called typographers.) For more standardized jobs, where type formats do not vary, typesetting skills can be learned on the job. According to case study interviews, however, employers prefer to hire people who have had some training, either in a vocational high school or a post-secondary technical school.

Half of all compositors and typesetters work in newspapers (Exhibit 7). Twenty-five percent work in commercial printing and most of the rest are employed by trade shops. Women hold a large proportion of these jobs (41% in 1980), though minorities are not well represented (3%).

Typesetters' wages vary considerably with experience and the complexity of the job. According to the 1986 DES manufacturing wage survey, workers who key in type for standardized jobs earn median weekly wages of approximately \$300. Case studies of firms in the Boston area suggest that experienced typesetters who set complex jobs can earn up to \$17.00 per hour. Union wages outside newspapers are reported at about \$15.00 per hour in Boston, and several dollars lower in other areas of the state.

2. Lithographers and photoengravers perform a variety of printing activities -- from producing negatives of the material to be printed to making printing plates. Lithographers work in offset printing, and engravers are employed in gravure and letterpress printing. In small shops a single worker will handle all the pre-press tasks; otherwise, workers will specialize as camera or scanner operators, lithographic artists, strippers,

Exhibit 7

Distribution of Occupational Groups by Major Industry Segment, 1983

	<u>Printing & Publishing Industry</u>	<u>Commercial Printing</u>	<u>News- papers</u>	<u>Book Publishing and Printing</u>	<u>Blankbooks and Bookbinding</u>	<u>Periodicals</u>	<u>Printing Trade Services</u>
Managerial	100%	34%	29%	14%	7%	8%	3%
Professional and Technical	100	13	53	12	.4	13	1
Writers & Editors	100	--	58	17	--	21	--
Reporters	100	--	97	--	--	3	--
Sales	100	22	47	7	8	11	2
Clerical	100	29	29	16	6	11	4
Service	100	27	47	13	9	--	1
Production*	100	45	21	12	15	1	2
Typesetters and Compositors	100	25	50	4	5	3	11
Lithographers and Photoengravers	100	68	8	18	.3	.4	3
Press Operators	100	65	16	12	3	1	.1
Binding and Finishing Workers	100	44	1	12	43	.1	--

Totals may not sum to 100% due to exclusion of Miscellaneous Publishing, Business Forms and Greeting Cards

* Detailed data given for selected occupational categories only

Source: Division of Employment Security, Occupational Employment Statistics program

or platemakers. Camera and scanner workers produce negatives of copy and graphics using either photographic equipment or computerized laser scanners; some specialize in developing and enhancing photos and artwork for reproduction. Strippers cut and arrange negatives of photos and text into a negative image of the page. Platemakers create the plates for the presses, transferring the negative image to the plate through a photographic exposure process. Workers in these occupations are primarily male (82%) and white (96%).

Commercial printers employ over two-thirds of both photoengravers and lithographers, including the more specialized pre-press workers, such as strippers. These firms produce the highest quality printed products with the most extensive use of color. In addition, many commercial printers serve highly specialized markets, and thus may require highly-skilled and specialized personnel. Eighteen percent of these workers are employed in book printing and publishing, while most of the rest work in newspapers.

Most lithographic and photoengraving workers learn their skills through either long-term on-the-job training or formal apprenticeships. Outside the workplace, technical institutes, four-year colleges, and community colleges offer two- and four-year programs in lithographic arts. Employers interviewed preferred to hire workers for platemaking, stripping, and camera jobs who have had a vocational or trade school education, but also stressed the importance of on-the-job training and skills learned through work experience.

Interviews with eastern Massachusetts employers revealed a wide range of wages -- from \$7.00 for entry-level workers to \$17.00 for those with

substantial experience. In the Boston area, union hourly wages for color strippers and scanner operators are reported at about \$15.00 and \$17.00, respectively. In a recent sample of Massachusetts newspapers, camera operators earned between \$7.50 and \$10.00 per hour. National data indicate that average wages for unionized lithographers and photoengravers are approximately \$16.00 per hour.

Press Operators

These workers set up and run printing presses. On traditional letter presses, they pack the heavy lead plates onto the cylinder, a logistically difficult task. Offset presses use much lighter plates, making preparation easier. Press operators are responsible for maintaining high printing quality -- adjusting the flow of ink to the page, monitoring the complex reproduction of color photos and graphics, ensuring that the paper is fed properly and the pressure of the printing cylinder on the page is adequate. With high-speed web offset presses, this requires careful monitoring of many variables and adjusting controls quickly and accurately to avoid waste. In addition, these operators maintain and at times repair the presses.

The majority of these jobs are filled by white males. Only 12% of the state's press operators are women, according to the 1980 Census, while 5% are members of minority groups.

Almost two-thirds of the industry's press operators are employed in commercial print shops, while most of the rest (16%) work for newspapers or in book printing and publishing (12%). Most press operators learn their

skills on the job. In many cases -- particularly in the newspaper sector, which has traditionally been heavily unionized -- workers must complete a four-year apprenticeship in a press room. Commercial printing firms, which are mostly non-union, typically do not have apprenticeship programs. Case study interviews suggest, however, that commercial printing employers use a less formal, but equally lengthy, process to train press workers on the job. Commercial printers usually hire high school or vocational school graduates as press helpers. After approximately four years, these workers will have learned the skills necessary to become a head press operator.

Median wages for press operators reported in the DES wage survey are approximately \$8.00 per hour, similar to those of the average Massachusetts production worker. In the case study firms, press operators' wages were even higher, from \$11.50 to \$15.00 per hour, and increased with experience and expertise in color printing processes. Unionized press operators in the Boston area earn between \$12.00 and \$16.00 per hour.

Binding and Finishing Workers

Workers involved in binding assemble books and periodicals in hard-bound volumes, requiring skills as varied as stitching and letter engraving, or operate machines that perform a range of binding tasks -- gathering up pages, shaping bookbodies, or inserting spiral backbones. A small portion of these workers -- particularly those involved in binding repairs and restoration -- are highly skilled, having been trained over a period of several years. Others are semi-skilled machine tenders, trained for the most part on the job. Bookbinding jobs are approximately evenly divided between men and women. Forty-three percent of these workers are employed by

the blankbook and book binding sector, which is dominated by blankbook production; the commercial printing industry is the other major employer (42%).

Case studies suggest that bookbinding jobs in non-union shops pay between \$4.50 and \$10.00 per hour. In the Boston area, unionized bookbinders' wages range from \$11.00 to \$15.00 per hour.

Newspaper Mailroom, Other Production, and Distribution Workers

Approximately 13% of the industry's employment is comprised of semi-skilled workers such as newspaper mailroom inserting machine operators, other machine operators, packers and wrappers, and truck drivers. Most of these jobs are in the newspaper (36%) and commercial printing (38%) sectors. Mailroom workers typically earn between \$6.00 and \$7.00 per hour except in some unionized papers where mailers have parity with other workers and thus earn much higher wages. Operators' jobs seem to be roughly equally divided among men and women. As is the case with printing and publishing overall, however, minority groups are underrepresented.

Front Office Jobs

Writers, reporters, artists, and photographers are the people -- both generalists and specialists -- who provide the copy for the industry. Most have had professional training and/or a college education; in some cases -- e.g., drama critics -- extensive professional experience is a prerequisite. Editors make the decisions about the content of the finished product -- the kinds of stories, photos and artwork -- and assign responsibilities for the

work to staff or external professionals. They then assess that work, rewriting and overseeing any necessary changes. Either extensive experience or training in a subject specialty is usually necessary. Almost all reporters (97%) and photographers (78%) work in newspapers. More than half (58%) of all writers and editors are employed by newspapers; the rest work in periodicals (21%) and in book printing and publishing (17%).

Salaries for editorial jobs vary with experience, and also vary considerably by location and employer. According to case study interviews, reporters in non-union papers may start at \$180 per week, while unionized reporters earn weekly salaries of between \$380 and \$700. The salaries of experienced artists and photographers in unionized newspapers in the Boston area range between \$500 and \$800 weekly. Editors' salaries also start in the range of \$500 weekly, but can go much higher, depending on experience and the circulation of the newspaper. Wages for front office jobs outside of newspapers are not available.

Sales workers account for a significant share of employment in the newspaper (10%) and book industries (11%). In contrast, less than 4% of jobs in the commercial printing and sector only 1% in trade shops are in sales.

Clerical jobs comprise a large share of printing and publishing employment. The industry's advertising clerks, circulation clerks, and messengers are employed predominantly (69%) in the newspaper sector. A few of the sectors, including periodicals and books, have a high proportion (39% and 25%, respectively) of their employment in clerical occupations. Most of

these jobs are as secretaries, typists, and accounting and general office clerks. Pay varies widely depending on the job and firm. Accounting, circulation, payroll and advertising clerks in case study firms in the Boston area earned hourly starting wages from \$7.00 to more than \$9.00, though wages were often higher in unionized workplaces.

TECHNOLOGICAL CHANGE

Although technological change is occurring throughout the printing and publishing industry and in virtually all of the phases of the printing process, the adoption of new technologies has not taken place evenly across the various segments (e.g., newspapers, commercial printing) of the industry. Moreover, in some cases new innovations are part of an ongoing process which began in the 1970's or earlier.

With these points in mind, the following paragraphs describe the major technological changes affecting printing and publishing and highlight some of the important implications of these innovations for the production process (Exhibit 8). Each technology is discussed under one of four categories, which correspond to the basic stages of the printing process: pre-press, including composition (the setting of type and graphics and their arrangement in page form) and platemaking; presswork; and finishing and binding. There is also a discussion of technological change in newspaper mailrooms, where pre-printed material is inserted and the papers are counted, stacked, and bundled in preparation for distribution.

Composition: The shift from "hot metal" typesetting to electronic photocomposition and the development of electronic "pagination" systems are the two most important innovations that have affected composition. Photocomposition, which began in newspapers during the mid- to late-1960's, spread throughout the printing and publishing industry over the next decade. By the beginning of the 1980's, hot metal composition had for all practical purposes become obsolete. The adoption of pagination, on the other hand, is still in its early stages. In combination with the

Exhibit 8

Major Technological Changes Influencing Employment in the Printing and Publishing Industry

<u>Technology</u> ¹	<u>Labor Impact</u> ²	<u>Time Frame</u>
Electronic photocomposition; integration of photocomposition with front office video display terminals	Greatly reduced labor requirements for typesetters.	First implemented in the mid-1960s. Technology is currently widely used.
Pagination: electronic integration of text and graphics	Reduces labor requirements for paste-up workers and strippers. May affect typesetters as well. As technology becomes more sophisticated in its handling of graphics, labor requirements for camera workers and artists may also be reduced.	First used circa 1980. Full pagination currently in use only in small newspapers and in a limited number of large national magazines and newspapers. Technology is expected to be used throughout the industry by 1995.
Computer-to-plate system	Reduces requirements for platemakers and camera workers.	New technology; currently in use by a small number of gravure printers. Not yet capable of producing lithographic plates.
Electronic color separation	Reduces labor requirements for lithographic artists. Increases requirements for scanner operators.	Introduced circa 1972. It is estimated that 85% of color work is currently done on electronic scanners.
Plateless printing: xerographic, ink jet, laser methods	Eliminates platemaking work entirely.	Used since the mid-seventies for low quality, small quantity jobs. It technology is refined, pressureless printing may be used more widely.
High speed computerized offset presses	Increase pace of work. Number of press operators per press may be reduced.	Introduced circa 1982. Technology continues to be incrementally improved.

- ¹ Technologies and their impacts are greatly simplified for brevity in this table. Please refer to the text for greater detail on particular technologies.
- ² Labor impact refers only to changes in per unit labor requirements resulting from new technologies. Other factors will influence net labor demand. For example, increased use of color in newspaper and commercial printing may lead to an overall increase in the demand for lithographic artists, even while electronic scanners are reducing the per unit labor requirements of the color separation process.

widespread use of video display terminals (VDT's), photocomposition has significantly reduced the amount of labor required to set a line of type, particularly in newspapers. It has also modified skills so that workers can be trained in a much shorter period of time. The continued development of full pagination systems may eventually have an even more profound labor impact by eliminating or at least greatly reducing composition as a distinct occupation.

In hot metal composition, type was set by a skilled craft worker at a linotype, which generated lines of raised metal type that were subsequently arranged in page form. In photocomposition, an operator uses a computer terminal linked to a phototypesetter, which generates flat printed lines of type, usually on photosensitive paper.

In the early stages of the development of photocomposition, typesetting of text was generally the task of a specific group of workers, frequently linotype operators who had been retrained as photocompositors. The material to be typeset was first typed or hand written by a writer, a reporter or an editor, and was then given to the typesetter. The growing use of VDT's in the front office, which gained a toehold in newspapers in the mid-1970's and became widespread by the early 1980's, has in most cases eliminated this second step, which is in essence a re-typing process. In newspapers, reporters and editors can now write and edit directly on a VDT, which is hooked up to a central computer which in turn drives the phototypesetter. (In smaller papers that do not have integrated systems of this sort, a reporter may write a story on a personal computer, and then give the disk to an editor who edits the piece on his or her own PC.)

In the terminology of the printing industry, the general adoption of VDT's thus allows for the "capturing of the original keystroke." As a result, in newspapers the role of the typesetting worker is often limited to the composition of ads and material such as letters to the editor, television listings, and other material that is normally not produced in the newsroom. Outside of newspapers, most typesetting is done by specialized trade shops or by commercial printers. To the extent that copy delivered to the trade shop or printer is not on a computer disk or in camera-ready form, the typesetting function remains. Typesetting may be reduced even in these areas, however, by the development of "desktop publishing" systems in which camera-ready copy can be produced "in house" by business firms, government offices, and other important users of printing services.

In addition to its effect on unit labor requirements, photocomposition has had an important impact on typesetting skills. Some of the traditional functions of the typesetting craft worker, such as hyphenation and line justification, have been automated, thereby removing them from the control of the typesetter. On the other hand, in some systems typesetters enter codes that control typeface and spacing. Still, in contrast to the era of hot metal, in which typesetting was performed by craft workers who were trained in six-year apprenticeship programs, electronic photocomposition can in many instances be performed by workers with appreciably less training.

The implications of photocomposition for compositors who arrange type and graphics into pages has been somewhat less dramatic. In a hot metal process, metal type and photoengravings are arranged and locked into a metal frame. Under photocomposition, metal type and engravings are replaced by strips of photosensitive paper and graphics which are pasted onto a layout

sheet. Under both processes, skill is required to make the different pieces fit together into a coherent page. The process must also be accomplished quickly, particularly in newspapers which are operating under tight deadlines. Although the skills of paste-up workers are not identical to those of a worker who arranges metal type, it is not clear that the skill requirements are significantly different.

The transition from hot metal to photocomposition has reduced per unit typesetting labor requirements and has modified typesetters' skills; the development of electronic pagination threatens to eliminate composition as a separate function altogether. With full pagination, text and graphics can be integrated and pages made up electronically on a VDT; a phototypesetting machine can then generate camera-ready copy in page form. In some systems, a negative can be produced directly, without using a camera. In either case, the need for paste-up is eliminated.

Pagination systems are in place at the Wall Street Journal and in large national magazines such as Time and Newsweek. In general, through, the adoption of pagination systems by major newspapers has been limited, primarily by the difficulty that existing systems have in storing massive amounts of data and the expense of investing in these systems. Some smaller weeklies, however, utilize full pagination systems on personal computers.

One promising application of pagination is in desktop publishing, in which material to be printed is composed in-house by non-printing establishments. Early versions of desktop publishing systems were essentially personal computers linked to laser printers. Printing quality, which was relatively poor and suited primarily for internal documents, has

greatly improved with the adoption of higher-resolution laser printers. More recently, electronic technical publishing (ETP) systems have been developed which not only integrate text and graphics but can be hooked up to "image setters" that produce fully-made-up, camera-ready copy or in some cases a negative. The copy or negative is then taken "outside" (to a commercial printer) for printing.

While these systems reduce pre-press unit labor requirements, they also raise firms' capacity to generate material to be printed, and may therefore have a positive impact on platemaking, press work, and finishing occupations in commercial printing.

Platemaking: The effects of the shift from hot metal to photocomposition have not been limited to the composing room, but have extended to platemaking as well. Hot metal composition was associated with letterpress printing, which used a raised printing plate that was made from a mold by a process called stereotyping. With photocomposition, plates are made by a photographic exposure process. The photographic process has also largely replaced photoengraving, under which metal reliefs are made of photographs, graphics, and other material that cannot be typeset. A computer-to-plate process which uses a laser to produce a plate or gravure cylinder directly from a pagination system is still evolving and has had only limited application, primarily in gravure printing. The technology for making lithographic plates is not yet workable.

In some major newspapers and commercial printers, the camera used in the photographic exposure process has given way to a laser scanner, which reduces the need for camera operators. Scanners can also be integrated into

a data transmission system, in which the image of a made-up page is sent electronically from a main printing plant to "satellite" plants. In this type of data transmission, which is found most often in newspapers, plates can be made automatically when the image is received, so that there is no need for typesetters, make-up workers, or platemakers in satellite plants. The ability to transmit data, however, may encourage newspapers (and perhaps other types of printers) to establish additional plants, and may thereby create jobs in presswork and in mailrooms.

Electronic scanners are also widely used in color separation, the process of separating a color negative or slide into its constituent subtractive primary colors so that printing plates can be made. Color separation was traditionally a very labor-intensive process carried out by highly-skilled craft workers who were often in short supply. The use of scanners has eliminated many of the manual operations that were formerly involved in color separation and has significantly increased speeds, thereby modifying skill requirements and lowering labor requirements per separation. However, as indicated in a later section, the demand for color printing has grown rapidly; hence, overall employment of workers doing color separation has actually increased.

Presswork: The major innovations that have affected presswork include the shift from letterpress to lithography; the growth of web offset printing; and the development of automatic and, in some cases, computerized press controls. Although technological change in the pressroom has required adjustment on the part of press operators, the effects of such change have not been as far-reaching as has been the case, for example, in the composing room. In the words of one analyst, "the pressroom is the only stage of the

modern printing operation where some traditional craft skills have been preserved."²

Offset, in which the image to be printed is transferred from the printing plate to a "blanket" cylinder and from the blanket to paper, is the most widely-used lithographic procedure. Lithographic plates are extremely light and flexible; in consequence, the process of mounting the plate on the press and ensuring that it meets the printing surface properly is much easier than was the case with conventional letterpress, which utilized plates weighing over 40 pounds and which were more likely to have uneven surfaces.

Web offset printing is a process in which the paper is fed into the press on a continuous roll, in contrast to a sheet-fed press which prints on individual sheets. Newspapers have historically used web feeding in both letterpress and lithographic printing; hence, the growth of web offset has been most pronounced outside of newspapers. Web offset allows for higher press speeds and, in newer models, reduced paper waste. The higher speeds increase output per press, but also place increased physical and mental demands on press operators.

The growing automation of presses is probably the most significant technological development in the presswork phase. In any press operation, ink must be prepared with the proper thickness and distributed across the rollers, and it is necessary to control the margins and registration. In lithography, a proper ink/water balance must also be maintained. Once the press is running, all of these elements must be monitored. Historically,

these functions were carried out mechanically. However, they are increasingly subject to automation, in some cases via a central computer control panel that can control the operations of a number of presses.

The consequences for workers of the trend toward automated controls seems clear. These controls generally increase the speed and accuracy of press operations; as a result, operators are no longer as necessary for some of these functions as they once were, thereby reducing the amount of labor required per press and modifying skill requirements.

Finishing and binding: Finishing involves operations such as stamping, folding, and gluing of printed materials, while binding is the process of converting these materials into books, periodicals, catalogs, and the like. These operations have traditionally been very labor-intensive and involved a large number of manual procedures. This was in some degree due to a low level of standardization of product types and sizes. As standardization has become more common, mechanization and automation have increased. New equipment can perform several operations that were previously separate, such as collating, gluing, and numbering, while automatic controls are being applied to loading, stitching, stamping, and related equipment. The result has been to reduce the amount of labor required per unit of output. To the extent that these innovations have substituted machine operators for manual craft workers, the overall skill requirements in binding and finishing have been changed as well.

Newspaper mailrooms: Mailrooms are where newspapers are prepared for distribution. Advertising or other inserts are placed in the papers, and they are counted, stacked, and tied in bundles. These functions were

traditionally carried out by semi-skilled manual workers, but this area of newspaper production has increasingly been targeted for technological innovations aimed at increasing productivity. In large measure, the interest of newspaper management in the mailroom is a by-product of the growing importance of advertising inserts and flyers as a source of newspaper revenue. Given the high speeds of offset presses and the urgency of distributing newspapers in a timely fashion, reliance on manual insertion would likely lead to bottlenecks.

The kinds of productivity-increasing technologies that have been introduced include conveyors and machines that count, stack, bundle, and insert. Innovations in the mailroom may also lead to modification of skills, as manual workers are re-trained as semi-skilled operatives to monitor the new machinery. At the same time, however, these changes have lowered per-unit labor requirements. The overall impacts of technological and other developments on mailroom workers is discussed more fully in a later section of this report.

EMPLOYMENT IMPACT OF CHANGE IN THE PRINTING AND PUBLISHING INDUSTRY

A variety of forces affect the demand for the products of the printing and publishing industry. Cyclical fluctuations in the economy and in advertising spending directly influence the market for printed products. Moreover, printing and publishing firms compete with other media for advertising revenue. Demographic trends and changes in international markets also have an impact on particular segments of the industry. Overall, however, most printing and publishing segments are experiencing growth in demand, although at different rates.

Technological change, which has had a significant impact over the last twenty years, is still the most important force affecting the supply side of the industry. Investments in new printing technology make it possible for firms to produce more output per worker. The types of jobs that workers perform is also changing as new technology is adopted.

Future employment trends in printing and publishing will reflect the combined effect of technological change and demand growth, and thus will vary across different parts of the industry. In low-growth sectors, net job loss may occur; in other sectors, employment may actually rise because of growth in demand. Overall, the printing and publishing industry was projected by DES to show a net increase in employment of 10% between 1984 and 1995.

The impact of technological change on specific printing occupations will also depend on the extent to which firms in each segment of the industry invest in new technology and expand business volume. As many of

the new technologies are modifications of processes introduced over the last two decades, however, it is important to understand how technology has affected occupations up to this point. This section of the report looks at how technological developments as well as other factors have affected employment levels and the types of work performed by each of the occupational groups within the printing and publishing industry.

Typesetting Occupations

1. Newspapers

The development of electronic photocomposition and the widespread use of VDT's, described earlier in this report, substantially changed the work performed by typesetters and compositors and reduced the number of workers required to produce a line of type. The impact of this change on employment levels in newspapers has been dramatic. In a national study of 371 newspapers, the RAND Corporation found that aggregate employment in composing rooms fell by an average of 52% between the early 1960's (before photocomposition was introduced) and 1983, by which time photocomposition equipment and VDTs had been adopted throughout the industry. This labor reduction was achieved primarily through attrition, lump-sum compensation payments to workers who voluntarily left their jobs, and some retraining. Worker layoffs were uncommon, especially in both unionized newspapers and in the smallest and very largest firms in the industry.

During this transition period, printers' unions attempted to negotiate over the introduction of new technology. These negotiations were characterized by a great deal of strife: nationally, many union locals were

ultimately broken, and a wave of union decertifications took place throughout the newspaper industry.

In Massachusetts, printers' unions remained; however, composing room employment in large newspapers is currently far below pre-photocomposition levels. One firm interviewed has reduced the number of composing room workers by half over the last ten years, largely through early retirement incentives and attrition. No layoffs have been undertaken by this firm.

Whereas photocomposition reduced the need for typesetters, new electronic pagination technology will primarily affect compositors. In the near term, however, these occupations will not be severely affected. DES projected that compositors' and typesetters' jobs in Massachusetts will decline 6.4% between 1984 and 1995. Eventually, large newspapers will adopt electronic pagination because of the speed and flexibility that an all-electronic process offers. Newspapers interviewed for this study, however, have not yet invested in full pagination systems, due largely to the technological or cost constraints noted earlier in this report. Currently, at some of the firms interviewed, compositors continue to make up display ads and do page layout, either electronically or by hand.

The effect of pagination on typesetters and compositors will vary from firm to firm. At unionized newspapers, workers will bargain explicitly over the impacts of electronic pagination. As these systems are introduced, unions are likely to negotiate for existing composing room workers to be retrained to operate the new machines, aiding newspapers' transition to a fully electronic process. At non-union firms, workers may have less opportunity to retrain.

Typesetters and compositors in smaller newspapers will also be affected as more of these firms upgrade existing photocomposition systems and adopt electronic pagination. Currently, in papers with partial pagination, typesetters arrange columns of type and insert headlines electronically, while compositors paste in display ads and other graphics. Full pagination systems that fully integrate display ads and graphics with text may eliminate the need for compositors, and may affect typesetters' jobs as well. One newspaper interviewed planned to retrain experienced workers, particularly typesetters, to operate their new systems.

Low-cost pagination systems of the type commonly used in desktop publishing make it possible to start up small newsletters or newspapers with few, if any, typesetters or compositors. Thus, growth in the number of small suburban or weekly newspapers may not result in corresponding employment growth for these pre-press occupations.

2. Commercial Printing

A smaller share (30%) of typesetters and compositors work in commercial printing. Photocomposition also reduced unit labor requirements for typesetting in this sector, but the reduction has been largely offset by growth in product demand.

It is not clear how quickly commercial printers will take up the next generation of electronic pagination systems. Printers interviewed for this study predicted different scenarios regarding the impact of new pagination technology on employment. Some firms plan to invest in pagination systems in order to augment their ability to produce high quality, fast turnaround

work; several employers expect to increase their business volume and retrain any workers who are displaced by new technology. Other commercial printers may begin to contract more with trade shops that have invested in advanced equipment, reducing or eliminating their need for typesetters.

In the long run, compositors' jobs in commercial printing will probably be reduced as firms begin to use electronic pagination equipment. Demand growth in commercial printing may initially offset job loss among typesetting and composition occupations, but the impact and timing of the transition to full pagination will vary at individual firms.

Electronic pagination or ETP systems may also allow typesetting and composition functions that would otherwise take place in trade shops and commercial printers to be shifted in-house, which could reduce the printing and publishing industry's demand for labor in those occupations. Firms that already have in-house typesetting and printing services may continue using the same skilled staff when electronic systems are adopted. In many companies, however, office workers will operate desktop publishing equipment: word processing skills already developed by clerical and administrative staff may be directly transferable to new ETP systems. Depending on the types of documents that companies produce using ETP systems, equipment operators may also need to learn layout or design to complement word processing skills.

Platemaking Occupations

Strippers, camera operators, platemakers, and other types of lithographers are all currently in demand, both in newspapers and commercial printing, but these pre-press occupations will also be affected as more advanced technology is adopted. Electronic pagination systems that are capable of producing fully-composed pages on film and re-touching as well as sizing photographs may greatly reduce the need for strippers and camera operators. Platemakers will not be affected directly by pagination, but the demand for this occupation may be reduced as plateless printing methods are improved. One newspaper firm included in this survey uses a laser process to produce negatives, thereby reducing the need for camera operators; however, printing plates must still be prepared from the negatives.

Increased business volume in the newspaper industry, due to circulation growth among suburban papers and growth in the "zoned" editions of metropolitan daily papers, will help in the near term to maintain demand for platemaking occupations. Large newspapers are expected to increase their use of color, and may require a small number of lithographers to do color separation work in-house.

The demand by commercial printers for workers in platemaking will vary, as it will for typesetting, depending on business growth and the type of pagination systems adopted at individual firms. Strippers are currently reported to be in high demand, but much of stripping will be automated as full pagination becomes more widespread. Due to a growing market for high-quality color printed materials, particularly in periodicals and books, some commercial printers are beginning to invest in advanced electronic color

scanning equipment. One industry source interviewed suggested that strippers whose jobs are automated by advanced pagination technology may be retrained to operate color scanning equipment. The demand for platemakers may be reduced as plateless printing equipment, such as the xerographic-type equipment currently used primarily in quick-print shops, is developed for the large volume, high-quality work handled by commercial printers.

Press Operators

Technological innovation has also affected workers in the pressroom. As outlined previously, automatic press controls and computerization allow for reduced manning levels per press, and lithographic plates can be mounted on the press with greater ease than was the case under a conventional letterpress process. On the other hand, the newer presses can run at up to twice the speed of the older models, which places increased demands upon operators in terms of monitoring and adjustment. In a word, the operation of a press still requires skill and experience.

In spite of the potential to reduce the number of operators per press, employment of press operators has increased during the 1980's in Massachusetts. In part, this may be attributable to the ability of workers in unionized newspapers and commercial printing firms to maintain manning levels through collective bargaining agreements. A much larger role has been played by the growth in demand for commercial printing, which employs almost three-quarters of press operators in the printing and publishing industry as a whole, and by increased newspaper circulation. Taken together, demand growth in these segments has apparently offset any declines in manning levels that have taken place.

Over the next several years, employment in press work will continue to be determined primarily by developments affecting commercial printing and newspapers. Managers of commercial printing firms interviewed as part of the case studies planned to expand employment of press operators in the future; they expressed particular interest in printers with experience on multi-color presses. In addition, a representative of a daily newspaper described a general shortage of newspaper press operators in the local area.

Although employment of press operators may increase, an important question is at what rate. According to DES industry projections, employment in commercial firms and newspaper will rise by 9.6% and 6.3%, respectively, for the 1984-1995 period. Thus, in comparison to the 1980-1985 period, overall job growth in each of these sectors will slow down, perhaps as a consequence of a slowing of demand growth coupled with steadily rising productivity. Press operator employment in all of the printing and publishing segments taken together is projected by DES to increase by 13% for the 1984-1995 period, an average increase of just over 1% per year.

Two additional developments may affect employment prospects for press operators. One is the expanded use of plateless printing processes, such as xerography, which are currently used primarily in quick-print shops or by commercial printers for fast turn-around work where high quality is not an important consideration. One industry expert expects these technologies to improve in the future, to the point where they may replace some of the conventional presswork that is done at commercial print shops. In this scenario, less-skilled machine operators could therefore to some extent replace skilled press workers. Another development is the growing importance of out-sourcing of large-volume production of children's books,

art books, and blankbooks in countries such as Taiwan, Singapore, and Ireland. In Massachusetts, however, relatively few press operators are employed in the book industry, while newspapers and commercial printing are fairly well isolated from international developments such as imports and outsourcing.

Binding, Finishing and Mailroom Occupations

Binding, finishing and newspaper mailroom operations are likely to be increasingly automated in the future. Although semi-automatic machines are already used throughout most binding and finishing work, this process remains highly labor-intensive. Case study interviews indicate that print shops and binderies will seek to reduce labor costs and shorten turn-around time by investing in more highly automated binding and finishing equipment. Newspapers, which rely increasingly on pre-printed inserts for advertising revenue, are also concerned with reducing the labor costs associated with mailroom operations.

The automation of binding and finishing work has occurred gradually in most sectors of the industry, and will continue to have an incremental rather than a drastic impact on employment. Investments in new equipment will likely reduce labor requirements in this area; DES has projected employment in bindery operations to decline 6.4% from 1984 to 1995. However, the impact of automation may also be offset to some degree by growth in volume. Finishing and shipping operations will continue to be important both for printers, who rely on fast turnaround and delivery for competitive advantage, and for newspapers seeking to develop zoned advertising markets.

CONCLUSION

The printing and publishing industry is a traditional manufacturing industry that will continue to thrive in Massachusetts. The industry is relatively insulated from the international competition that has affected many other traditional manufacturing industries. Because of the linkages between printing and publishing and other growing sectors of the economy, the demand for printing services is likely to remain strong in future years. Encouraged by steady demand growth, firms in the industry have continued to undertake technological innovation.

The overall employment growth projected for printing and publishing is a welcome development because of the quality of the industry's jobs. Many of the jobs are relatively highly-paid. In addition, printing and publishing occupations typically have upward career paths.

While employment is growing, the industry continues to undergo change in production techniques, occupational structure, and the content of jobs. Since the mid-1960's, technological innovation has reduced per unit labor requirements in most phases of the production process. In general, growth in demand for the final product has offset these productivity improvements, and employment reductions have been avoided. In some cases, such as in newspaper typesetting, employment reductions have occurred. In unionized newspapers, workers and management have negotiated solutions such as retraining, job reduction through attrition, and severance packages to ease the transition for workers. As firms introduce new technologies in the future, additional employment declines may take place, particularly if demand growth slows down. Hence, retraining, separation pay, and similar

responses by employers may continue to be important in preventing or at least minimizing worker dislocation. Where these steps are inadequate, public re-training and placement efforts can also facilitate the process of adjustment.

Technological and other changes also have implications for employment and training policy. As new printing technology is introduced and job content and skills evolve, the industry's education and training requirements are changing. In addition, many types of highly-skilled printing workers are currently in short supply. Until recently, the apprenticeship system served as an important mechanism for both training and upward mobility in specific occupations. However, since apprenticeships are now no longer widely used, there is no uniform system for acquiring training and pursuing advancement in some printing trades.

In light of expected growth and change in the industry, some public/private planning for such a system seems important, if employers' hiring needs and workers' training requirements are to be met adequately. Printing employers, unions, equipment manufacturers, educators, and employment and training specialists all have considerable expertise with which to plan for the future manpower needs of the industry. A concerted effort among all of these groups would help to address the needs of both employers and workers, and could also create opportunities for women and minorities, who have traditionally been underrepresented in the industry.

Exhibit 9

Graphic Arts and Printing Trades Training Resources in Massachusetts

Two- and Four-Year College Programs:

Bunker Hill Community College, Charlestown	241-8600
Fitchburg State College, Fitchburg	727-4556
Greenfield Community College, Greenfield	727-0962
Massasoit Community College, Brockton	727-1740
Northeastern University Graphic Arts Program, Boston	437-2390
Springfield Technical Community College, Springfield	727-1289

Trade Schools:

Printing Institute of New England, Natick	655-8700
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Union Schools:

Greater Boston Lithographic Institute (GCIU), Revere	284-1745
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For current information on vocational school programs, contact the occupational education team leader at one of the following Regional Education Centers:

Central Massachusetts Reg. Ed. Ctr., W. Boylston	727-1346, 835-6266
Greater Boston Reg. Ed. Ctr., Arlington	727-1470, 641-4870
North East Reg. Ed. Ctr., N. Reading	727-0600, 664-5723
North West Reg. Ed. Ctr., North Adams	727-8452, 664-4511
South East Reg. Ed. Ctr., Lakeville	727-1440, 947-1231
Greater Springfield Reg. Ed. Ctr., Springfield	727-7166, 739-7271

Courses in printing and graphic arts have also been offered at:

Boston Center for Adult Education
Massachusetts College of Art
New England School of Art and Design
Pine Manor College
Somerville Evening School

For a more complete listing of courses, contact the Educational Exchange of Greater Boston 876-3080

NOTE ON DATA SOURCES

This study relies on published data as well as information gathered through interviews with union officials and from case studies of firms in the key segments of the printing and publishing industry. The major published sources include DES ES-202 reports, which provide data on industry and area employment levels; the Occupational Employment Statistics (OES) program, for data on industry occupational distributions; the 1980 U.S. Census for worker demographics; DES industry and occupational projections; and, for wages, the DES publication Selected Occupational Wages in Manufacturing Industries, wage surveys carried out by the Inland Daily Press Association (newspapers) and Printing Industries of America (commercial printing), and the Bureau of Labor Statistics' Occupational Outlook Handbook. The case studies also provided wage data, as well as information on firms' investment plans, re-training and other policies used by companies to address the worker impacts of technological innovation, and other issues for which quantitative data are difficult or impossible to obtain.

FOOTNOTES

1. Gregory Giebel, "Changing Technology, Corporate Structure and Geographical Concentration in the Printing Industry," from Donald Kennedy, et al, Labor and Technology: Union Response to Changing Environments (Pennsylvania State University, 1982)
2. Andrew Zimbalist, "Technology and the Labor Process in the Printing Industry," from Zimbalist, Case Studies on the Labor Process (New York: Monthly Review Press, 1979)
3. James N. Dertouzas and Timothy H. Quinn, Bargaining Responses to the Technology Revolution: The Case of the Newspaper Industry (Santa Monica: The RAND Corporation, January, 1985)



